



NASA STTR 2006 Phase I Solicitation

T9 Stennis Space Center

The John C. Stennis Space Center (SSC) in south Mississippi is NASA's primary center for testing and flight certifying rocket propulsion systems for the Space Shuttle and future generations of space vehicles. Because of its important role in engine testing for four decades, Stennis Space Center is NASA's program manager for rocket propulsion testing with total responsibility for conducting and/or managing all NASA propulsion test programs. Stennis Space Center tests all Space Shuttle main engines. These high-performance, liquid-fueled engines provide most of the total impulse needed during the Shuttle's eight and one-half-minute-flight to orbit. All shuttle main engines must pass a series of test firings at Stennis Space Center prior to being installed in the back of the orbiter. The Earth Science Applications Directorate is NASA's Program Manager for Earth Science Applications. The Directorate matches NASA's scientific and technical knowledge with issues of national concern and the needs of our partners. Partners include local, state, and tribal governments, commercial industry, with educational and other non-profit institutions. Through the Directorate's co-funded partnerships, public and private sector decision makers learn how to apply new technologies to critical environmental, resource management, community growth, and disaster management issues. The Directorate also provides the remote sensing community with a comprehensive array of manmade and natural ground targets, measurement systems, and benchmark processes to help test airborne and space remote sensing systems against performance specifications and customer needs. Stennis Space Center began "re-inventing Government" decades ago before the concept became popular. Over the years, SSC has evolved into a multiagency, multidisciplinary center for Federal, state, academic, and private organizations engaged in space, oceans, environmental programs, and the national defense. In addition to NASA, there are 30 other agencies located at Stennis. Of approximately 4500 employees, about 1600 work in the fields of science and engineering. These agencies work side by side and share common costs related to infrastructure, facility, and technical services which makes it cheaper for each to accomplish its independent mission at SSC.

Subtopics

T9.01 Rocket Propulsion Testing Systems

Lead Center: SSC

Center: SSC

Proposals are sought for innovative technologies in the area of propulsion test operations. Proposals should support the reduction of overall propulsion test operations costs (recurring costs) and/or increase reliability and performance of propulsion ground test facilities and operations methodologies. Specific areas of interest in this

subtopic include the following:

Facility and Test Article Health-Monitoring Technologies

Innovative, non-intrusive sensors for measuring gas velocity, temperature, pressure, molecular and metallic plume constituents, and environmentally sensitive effluent gas detection. Low-millisecond to sub-millisecond response time is required. Temperature sensors must be able to measure cryogenic temperatures of fluids (as low as 160R for LOX and 34R for LH₂) under high pressure (up to 15,000 psi), high flow rate conditions (2000 lb/s 82 ft/s for LOX; 500 lb/s 300 ft/s for LH₂). Flow rate sensors must have a range of up to 2000 lb/s (82 ft/sec) for LOX and 500 lb/sec (300 ft/s) for LH₂. Pressure sensors must have a range up to 15,000 psi. Rocket plume sensors should be capable of measuring gas species, temperature, and velocity for H₂, O₂, hydrocarbon and hybrid fuels.

Rugged, high accuracy (0.2%), fast response, temperature measuring sensors and instrumentation for very high pressure, high flow rate cryogenic piping systems. Temperature sensors must be able to measure cryogenic temperatures of fluids (as low as 160R for LOX and 34R for LH₂) under high pressure (up to 15,000 psi), high flow rate conditions (2000 lb/s 82 ft/s for LOX; 500 lb/s 300 ft/s for LH₂). Response times must be on the order of a few milliseconds to sub-milliseconds.

Modeling, sensors, and instrumentation for prediction, characterization, and measurement of rocket engine combustion instability. Sensor systems should have bandwidth capabilities in excess of 100 kHz. Emphasis is on development of non-intrusive optical-based sensors.

Test Facility Modeling Tools and Methods

Developing and verifying test facilities is complex and expensive. The wide range of pressures, flow rates, and temperatures necessary for engine testing result in complex relationships and dynamics. It is not realistic to physically test each component and the component-to-component interaction in all states before designing a system. Currently, systems must be tuned after fabrication, requiring extensive testing and verification.

Tools using computational methods to accurately model and predict system performance are required that integrate simple interfaces with detailed design and/or analysis software. SSC is interested in improving capabilities and methods to accurately predict and model the transient fluid structure interaction between cryogenic fluids and immersed components to predict the dynamic loads, frequency response of facilities.

Component Design, Prediction and Modeling - Improved capabilities to predict and model the behavior of components (valves, check valves, chokes etc.) during the facility design process. This capability is required for modeling components in high pressure 12,000 psi, high flow 100 lb/sec cryogenic environments and must address two-phase flows.

Process System Design, Prediction and Modeling - Improved capabilities to predict and model process systems. The capability should incorporate the previous two areas to accurately model the process systems and test articles.

T9.02 Field Sensors, Instruments, and Related Technologies

Lead Center: SSC

Center: SSC

Coastal environments and their natural resources are vital to our Nation's economy, security, commerce and recreation. These environments are strongly impacted by severe weather and other natural hazards. Because most of the world's population lives in coastal regions, these important and dynamic environments are also significantly impacted by human-induced events. Moreover, they are also especially sensitive to the initial effects of global climate change.

This subtopic solicits innovative field measurement technologies and analytical tools to support NASA's remote sensing technologies used in coastal research and applications. Specific interests at SSC include the following:

- Coupling of land and ocean processes (run-off, air quality, material flux);
- Coral reef mapping and health;
- Algal blooms (detection and monitoring);
- Sea level rise (measuring and forecasting effects);
- Sediment and contaminant transport (measuring and monitoring);
- Natural disasters such as tropical systems, tsunamis, and floods (planning, impact assessment, mitigation, and recovery).